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THE POWER OF EXCELLENCE

A designer's guide to building smart batteries into medical applications

Many design engineers believe that, as its power source, the battery is the very heart of the product. However, I would go even deeper into the core of the battery and argue that it is the cell that is the nucleus of the battery, determining the performance, lifecycle and durability of the application.

There is no such thing as a typical battery design project. This is partly because bespoke power sources are used everywhere from hospitals to in-field military medical operations. Some customers might be looking for high energy capacity, whilst others might need low temperature performance, high availability, a longer cycle life or a specific battery size. In other words, finding out exactly what you want the battery to do for your piece of equipment is crucial to the success of the design.

As a result, the first thing the OEM and battery developer should consider in each case is cell selection. There are always a number of stakeholders in any OEM device design and it is important for everyone to be involved early in the development cycle, if the optimal battery solution is to be created. To select the most appropriate cell types one first needs to determine the power consumption of the application, the runtime requirements and environmental operating conditions. Feeding into this is the weight and volume budget and a requirement for the battery to meet specific cost targets.

The battery developer has a number of cell types available to them including Nickel Cadmium, Nickel-Metal Hydride, Lithium ion and Lithium ion Polymer. In recent years it is the Lithium ion chemistries that have dominated product development due to their high energy density and excellent safety record, but the older Nickel chemistries do still offer superior performance in certain applications.

One fundamental guideline is to decide whether the battery has to withstand extreme conditions such as freezing temperatures, scorching heats, humidity or dirt. In order to guarantee efficiency, we select only the type of cells that are suitable to these conditions.

Intelligent cell selection can also help ensure the future availability of the battery, which means the cell can be replaced if a superior version becomes available. This ensures a longer life-cycle for your battery and helps alleviate obsolescence related issues.

The design of the electronics embedded within the system is another key issue for the OEM and its battery partner to address. The battery itself is an integral part of something that

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Accutronics refers to as the power management 'triangle'. This consists of the actual device on one side and the battery and the charger on each of the other two sides.

The best way to ensure that the power management triangle principle is observed, is by using a common communication system – such as the Smart Battery System (SBS) – to determine the methods of communication between smart batteries, smart chargers and system devices.

A battery that has been designed to meet the SBS standards, controls how it's going to be charged by communicating with a smart charger and requesting the voltage and current it needs. This is the safest and most efficient way of charging the battery because it is always the battery itself that remains in control rather than having a charge regime imposed upon it.

The physical characteristics of a battery, such as its size, durability and weight, also play a crucial part in its design. Similarly, performance characteristics such as efficiency, reliability and availability are also crucial. For instance, portable medical devices might require a high tolerance to vibration, so that they can be used while transporting patients by helicopter.

Another important factor to consider, and one that applies to the integration of all sub-assembled components, is the availability of parts and their potential obsolescence. For this reason, engineers should avoid designing-in off the shelf consumer batteries. Our experience has shown that these are poorly supported technically and very likely to become obsolete quickly. This is a particular issue for medical products, which usually have a long life cycle, frequently spanning more than a decade.

Coming back to my original hypotheses, it becomes clear why the battery is the very heart of many medical devices. We might also argue that it is the quality of the design process which ensures the heart will continue to beat during the lifespan of the OEM's device. As long as this happens and the battery provides power in an efficient and precisely monitored way, the device itself will do the rest.